
REMARKS

The Office Action issued by the Examiner and the citations referred to in the Office Action have been carefully considered.

Interview

Applicant thanks the Examiner for time spent in an Interview on June 23, 2010, in which various proposed amendments were discussed, particularly with respect to enablement. The amendments above and the remarks below are considered responsive to the same.

Objections

The disclosure and claims 1 and 31-32 were objected to. Accordingly, amendments presented herein are believed to be response to the objections.

Rejections under 35 U.S.C. §112

Claims 1-49 were rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

As a preliminary matter, it is noted that the rejections reflect the International Preliminary Report on Patentability from the corresponding PCT case (PCT/US2004/024683). It should be noted that the applicable law differs between PCT applications and non-provisional applications before the USPTO. Objections made under PCT Rule 66.2(a)(v) do not necessarily give rise to rejections under 35 U.S.C. 112. Accordingly, reconsideration of each and every claim is requested with thorough analysis with respect to applicable law in the United States, with adequate support for any such rejections properly set forth.

References to “leak-tight” have been removed from the claims.

In claim 29, the “membrane reformer” refers to a device—not a process. The body of the claim recites at least one component (the “leak-tight coating disposed upon a substrate”) of the membrane reformer. Accordingly, it is implied that other, unrecited components may be combined with those recited to define the membrane reformer. Applicant is unaware of any rule or law that requires a device claim to expressly recite every component that could be implemented to perform a function inferred by the Examiner. Indication of such rule or law, if any exists, is greatly appreciated.

Claim 27 has been cancelled. The modifier “thin” in claim 29 has been removed.

Claims 2, 13, and 14 have been amended to clarify references to antecedents of “forming a leak-tight coating” and “thermal processing,” *inter alia*.

Claim 7 has been cancelled.

With respect to claim 12, specific etchants are recited as applied to the etching step of claim 9. As recited in claim 9, the etching step is performed on the diffusion barrier. Thus, it is respectfully submitted that claim 12 sufficiently recites the materials acting as well as the materials being acted upon.

Claim 11 has been amended to depend from claim 4.

With regard to claim 34, the Specification states: “Such etching provides surface roughness to provide better adhesion of the coating of metallic components of the metallic inks to the substrate surface or, if so provided, to a diffusion barrier layer provided upon the substrate surface.” [Specification, Paragraph 0075]. It is respectfully submitted that an “etched” feature provides specific structure and physical characteristics to the diffusion barrier.

With regard to claim 10 or 35, “polishing” is used throughout the specification and embodied by examples including “shot peening, ion-beam treatment, plasma deposition of metals and vapor deposition of metals.” [See Claims 10 and 35; Specification, paragraph 0014, 0020, and 0063]. Each of these are characterized by the common feature that a surface is made

more smooth thereby, as would be recognized by one having ordinary skill in the art. It is acknowledged in the Office Action that plasma or vapor deposition “result in a coating of shiny metal or a very smooth or planarized surface.” [See Office Action, page 4]. While the Office Action asserts that this is contrary to the Examiner’s interpretation of “polishing”, Applicant submits that usage of the word “polishing” has an ordinary meaning that includes smoothing by reformation of material, smoothing by removal of material, and smoothing by addition of material (e.g., shoe “polish”). To the extent that this definition departs from any plain meaning, the Specification uses the term to include such methods for providing a smooth or planarized surface. Accordingly “polishing” is defined by such processes inasmuch as the Specification uses the term to include the same. It is noted that a patentee may be his own lexicographer, giving meaning to words according to their usage in the Specification. MPEP 2111.01.

With regard to claims 16, 28, and 37 reciting the phrase “less than about,” it is well within acceptable USPTO guidelines and common practice before the USPTO. Its usage does not violate 35 U.S.C. 112. See *In re Geisler*, 116 F.3d 1465, 1471, 43 USPQ2d 1362, 1366 (Fed. Cir. 1997).

Other amendments have been made that may address issues raised in the Office Action. Reconsideration is kindly requested.

Rejections under 35 U.S.C. §102

Claims 1, 3-5, 8, 11, 13, 15, 16, 27-31, 36-37, 39-46 & 49 were rejected under 35 U.S.C. 102(b) as being anticipated by Ma et al (6,152,987).

Claims 1, 3-5, 11, 13, 15-18, 29-31 & 36-49 were rejected under 35 U.S.C. 102(b) as being anticipated by Ogawa et al (5,782,960).

Claims 1, 4, 13-16 & 27-28 were rejected under 35 U.S.C. 102(b) as being anticipated by Oyama et al. (6,527,833 B1).

Rejections under 35 U.S.C. §103

Claim 12 was rejected under 35 U.S.C. 103(a) as being unpatentable over Ma et al (6,152,987).

Claims 2, 17-26, 36-49 were rejected under 35 U.S.C. 103(a) as being unpatentable over Ma et al, in view of Hu (2001/0016236 A1).

By the above Amendment, Claims 2, 5-7, 19-20, 24, 32, 36, 39, and 43-44 are cancelled. Independent Claims 1 and 29 have been amended to include additional limitations. The remarks that follow are applied to each of Independent Claims 1 and 29 and the limitations thereof (which were previously presented in dependent claims) as those limitations gave rise to the rejections presented in the Office Action.

References Cited Do Not Teach Or Suggest A Polishing Step

Each of Independent Claims 1 and 29 recited that a surface of the substrate is polished by a surface treatment “whereby the at least one surface is smoothed and whereby bulk properties of the substrate remain unchanged.” This limitation, added by amendment, is supported by the Specification. For example, inasmuch as the Examiner has demonstrated that at least one embodiment of polishing results “in a coating of shiny metal or a very smooth or planarized surface,” it is respectfully submitted that the claims, as amended, do not add new matter and are supported by the Specification.

To satisfy the limitation of “polishing”, the Office Action relies on the combination of Ma et al (6,152,987) with Dye et al (6,214,090 B1) or Peachey et al.(5,738,708). It is respectfully submitted that the combination of these references is not obvious, and further that it fails to satisfy each and every limitations of the claims.

The Examiner suggests that the membranes of Dye and Peachey are analogous to the membrane of Ma. Ma teaches a membrane that is deposited on a porous metal substrate. [Ma, Abstract; Independent Claims 1 and 2].

In contrast, Dye and Peachey teach solid composite membranes that are not supported on a porous substrate. Rather, Dye discloses that “The composite multilayer membrane of the present invention is characterized as non-porous, i.e., there are no channels or passages that extend through the membrane for passage of gas molecules or the like.” [Dye, col. 3, lines 26-29; see also, Dye, Independent Claim 1; Peachey, Abstract and Independent Claim 1 (referring to the layers upon which materials are deposited as either “central metal film” or “central metal layer”)].

It is not explained in the Office Action how these different substrates are analogous or why one having ordinary skill in the art would assume that the process of Dye/Peachey being performed on a certain substrate would have an analogous effect on a substrate having opposite properties. Applicant respectfully submits that the opposite nature of the different substrates would have provided an obstacle to combination, as recognized by one having ordinary skill. [See Ma, col. 2, lines 8-15].

The examiner suggests that the central non-porous layer in Dye’s composite membrane that is sandwiched between Group VIII layers is analogous to the porous substrate in Ma. The central non-porous layer of Dye and Peachey transports hydrogen as hydrogen atoms, whereas the porous metal support of Ma transports hydrogen as molecular hydrogen. It is respectfully submitted that the disclosures of at least Ma and Dye are being interpreted too broadly.

“A method for fabricating a hydrogen gas-extraction membrane includes reacting the porous metal substrate with an oxidizing agent to form a ceramic intermediate layer on a surface of the porous metal substrate and covering the ceramic coating with the membrane layer that is selectively permeable to hydrogen” [Ma, Abstract, emphasis added]. “A method for forming a

hydrogen gas-extraction module of this invention includes oxidizing the surface of a porous substrate with an oxidizing agent to form an intermediate ceramic coating. The intermediate coating is then covered with a membrane that is selectively permeable to hydrogen such as palladium or a palladium/silver alloy.” [Ma, col. 2, lines 40-45]. In particular, the cleaning step referenced by the Examiner in Example 1 of Ma as being combinable with the processes of Dye/Peachey is followed in Ma by an oxidation step: “The cup was then oxidized with oxygen at 900° C. for 4 hours.” [Ma, col. 8, lines 9-10]. Ma discloses the purpose of its oxidized intermediate layer as follows:

This invention offers the advantages, for example, of providing an intermediate layer that effectively prevents diffusion between the substrate and the membrane that is selectively permeable to hydrogen. In-situ formation of the intermediate layer in accordance with the methods of this invention also can increase the hydrogen permeability of the composite module. Further, by deriving the oxidized intermediate layer from a metallic substrate, the fracture toughness and ductility of the metallic substrate can be retained. As a result, the module can be easily mated with other metallic parts. Further still, the methods for forming the gas-separation module of this invention are economical and relatively simple to perform. [Ma, col. 2, lines 46-58].

In contrast, Dye/Peachey disclose ion milling for the purpose of removing oxidation: “In one aspect of forming the composite membrane of the present invention, the central metal film is initially cleaned to remove any surface oxidation or contamination or other surface imperfections.” [Dye, col. 3, lines 30-33].

It is not provided in the Office Action why one having ordinary skill in the art would apply the process of Dye/Peachey to undermine the benefits of oxidation as disclosed in Ma. Whether the ion milling is performed before, after, or simultaneously with any cleaning step of Ma, it seems clear that the purpose and effect of the ion milling process of Dye/Peachey would render the oxidation step of Ma inoperable for its intended purpose. It is respectfully submitted that Ma and Dye/Peachey teach away from each other.

References Cited Do Not Teach Or Suggest A Step For A Direct-Write Laser

Independent claims 1 and 29 recite “a laser direct-write process” utilizing “a metallic ink having a metallic component and a carrier component, said metallic component comprising at least at least one of palladium, a palladium alloy, and a palladium and silver alloy.”

To satisfy the limitation of a “direct-write laser” step, the Office Action relies on the combination of Ma and Hu (2001/0016236 A1). It is respectfully submitted that the combination of these references is not obvious, and further that it fails to satisfy each and every limitations of the claims.

The Office Action states:

The Hu technique may pretreat a substrate (possibly porous metal) to be coated with a metal layer with a photocatalyst coating, then with a solution containing metal precursors, after which heat may be applied to evaporate liquid, and light that may be from a position-controlable laser beam to cause reduction to metal, and may be considered a laser writing process. [Office Action, pp. 7-8].

Applicants submit that even if the references could be combined (without suggesting that it is proper to do so), the combination fails to satisfy each and every limitation of the claims. Hu discloses a process utilizing metal precursors, rather than the metals. A person with ordinary skill in the art can readily appreciate that the solution containing metal precursors of Hu (suspension with metal salts) is very different from the metal-containing ink of the present claims. The materials in Hu cannot be considered a metallic ink including a “metallic component comprising at least at least one of palladium, a palladium alloy, and a palladium and silver alloy.” Further, the system and process of Hu is designed around the presumption that metal precursors are utilized, as demonstrated by the steps required to reduce the metal salts to the resultant metals during the process thereof, making modification thereof non-obvious without some motivation to do so.

Furthermore, the Office Action appears to treat two separate processes disclosed in Hu as if they were the same process.

In Paragraphs [006]-[007] of Hu, cited by the Office Action, the disclosure states that the liquid suspension is partly comprised of a plurality of PSI units, metal precursors, and any other component desired for effecting photochemical reaction. The suspension is contacted with light to form PSI-metal complexes. Generally, the suspension is provided above the surface of a solid or semisolid substrate. The liquid is then removed by heat or vacuum to yield a film on the substrate that is partly comprised of the metal from the PSI-metal complexes.

This treatment as disclosed is not a direct-write laser process. As discussed above, it is a process for reducing precursors to metal, rather than transfer of a metallic ink, as claimed. Furthermore, the Office Action states that “light that may be from a position-controlable laser beam to cause reduction to metal.” The use of a laser for reduction to metal is not found in the Hu reference, but rather appears to be from the Examiner’s own knowledge and experience. It is respectfully submitted that if such a modification is to be made to Hu, it must be supported by sufficient reasoning to show how it would have been obvious to one having ordinary skill in the art without using the claims as a guide. KSR Int’l Co. v. Teleflex, Inc., 127 S.Ct. 1727, 1747 (2007). As such reasoning was not provided (instead presenting the reference as if it had disclosed use of lasers for reduction to metal), it is respectfully submitted that a prima facie case of obviousness has not been presented.

Elsewhere in the disclosure of Hu, usage of lasers is disclosed for a separate and subsequent process step after reduction of the PSI units. In Paragraph [0034] of Hu, cited by the Office Action, the disclosure states:

In addition to the nanoparticles and continuous thin films described above, metallic patterns of nanoscale resolution may be prepared on a substrate surface by coupling laser and/or electron beam lithography techniques with the methods of this invention. For example, a position-controllable laser beam could be used to

~~provide precise deposition of metal particles and/or lines in essentially any desired pattern on the surface of a PSI-coated substrate.~~ [Hu, Paragraph 0034].

As disclosed, laser techniques are used only in combination with and subsequent to the reduction techniques discussed above. Hu does not specify use of a laser beam to cause reduction of metal as the examiner cites, nor does Hu disclose the use of lasers to provide any material directly to the substrate, as claimed above. Rather, Hu discloses the use of lasers as an additional step subsequent to reduction techniques. Accordingly, the laser technique provides its materials to the PSI coating, rather than to the substrate. Fabrication of metal patterns of nano-scale resolution on PSI-coated substrates is not the subject of the present claims.

As with other modifications presented in the Office Action, no reasoning is presented to support the modification of the Hu reference where Hu itself fails to satisfy the limitations of the claims above. It is respectfully submitted that a prima facie case of obviousness has not been presented.

The Office Action states: “The Hu technique may pretreat a substrate (possibly porous metal).” This inference appears to be made in an attempt to present Hu as readily compatible with the disclosure of Ma. However, the Examiner appears to be adding a separate specification to Hu.

Hu does not specify porous metal as a substrate upon which it may act. Hu does specify that his invention can be adapted for fabrication of various types of metal-ceramic membranes:

If the substrate on which the deposition is performed is a ceramic, the invention can be readily adapted for the fabrication of various types of metal-ceramic membranes, e.g., (1) dense or porous metallic membranes that are supported on porous ceramic membranes; (2) metals deposited inside the pores of ceramic membranes; and (3) metals coated on solid particles that are partially sintered onto inorganic membranes. [Hu, Paragraph 0035, emphasis added].

None of these substrates includes porous metal, as represented by the Office Action. Further, no reason to modify the disclosure of Hu to include the use of porous metal substrates is

provided. Accordingly, it is respectfully submitted that a prima facie case for obviousness has not been made because no reason to modify or combine the references has been provided.

For the above reasons, inter alia, reconsideration of independent claims 1 and 29 is kindly requested.

Dependent claims 3-4, 8-18, 21-23, 25-28, and 48 depend from independent claim 1. As the independent claim from which they depend is patentable, as discussed herein, claims 3-4, 8-18, 21-23, 25-28, and 48 are patentable. Reconsideration is respectfully requested.

Dependent claims 30-31, 33-35, 37-38, 40-42, 45-47, and 49 depend from independent claim 29. As the independent claim from which they depend is patentable, as discussed herein, claims 30-31, 33-35, 37-38, 40-42, 45-47, and 49 are patentable. Reconsideration is respectfully requested.

It is respectfully submitted that all of the Examiner's objections have been successfully addressed and that the application is now in order for allowance. Accordingly, reconsideration of the application and allowance thereof is courteously solicited.

A three month extension of time is requested herewith. The Director is authorized to charge any additional fee(s) or any underpayment of fee(s), or to credit any overpayments to **Deposit Account Number 50-2298**. Please ensure that Attorney Docket Number 37929-32401 is referred to when charging any payments or credits for this case.

Respectfully submitted,

Date: October 7, 2010

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